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Investigations of Parallel Dynamics in the ESEL Model

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The two dimensional, electrostatic edge-SOL turbulence code ESEL [1] simulates the perpendicular dynamics of transport events in the SOL together with a self consistent development of the SOL profiles at the outboard midplane. Profiles of density n, electron temperature Te, and vorticity are evolved together with the fluctuations, without making a scale separation-ansatz, i.e., allowing relative fluctuation levels of order unity and profile variations by orders of magnitude. Parallel losses in the SOL are described by the classical sub-sonic advection, the parallel length from the midplane to the diverter/wall and Spitzer-Härm diffusion, while perpendicular collisional dissipation is approximated by Pfirsch-Schlüter neoclassical diffusivities [2].

In [1] we demonstrated that based on basic plasma parameters from TCV, results from ESEL were reproducing experimental results obtained by a reciprocating probe in the TCV SOL. These results comprise radial profiles of density, poloidal velocity and particle transport, and temporal quantities such as conditional averaged signals and the first 4 moments of the PDF's.

In this presentation we discuss the parameterization of the parallel dynamics in more details. The assumption of classical sonic advection of vorticity is at first replaced by advection with the Alfven velocity, as discussed in, e.g., [3]. We observe that even though propagating blob structures are still produced, the blobs appear not to dominate the dynamics and the measured quantities are different from the standard case of ESEL and more important significantly different from the experimental observations. These results are consistent with assumption of low beta values in the SOL, implying that the blobs are propagating across an almost unperturbed magnetic field. When the field lines, which the blob is crossing, end on material surfaces and the parrellel current associated with the blob allready reach these surfaces, then the sheath boundary conditions take over, see e.g. [3]. For highly collisional SOL conditions with detached divertor the sonnic advection may describe the parallel losses reasonably, see e.g. [1].

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